Journal of the American College of Cardiology
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Published by Elsevier Inc.

Vol. 62, No. 16, 2013
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2013.03.069

EDITORIAL COMMENT

Aspiration Thrombectomy

It's About Time*

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In an elegant meta-analysis published 5 years ago, Bavry et al. (1) reported that aspiration thrombectomy prior to percutaneous coronary intervention (PCI) in acute ST segment–elevation myocardial infarction (STEMI) can be beneficial. Using data from 30 studies of 6,415 patients, they found improvements in 2 surrogate markers of coronary flow and reperfusion, with more Thrombolysis In Myocardial Infarction (TIMI) blush grade of 3 at the conclusion of the procedure, and more ST-segment resolution (STR) in the group with aspiration thrombectomy compared with PCI without thrombectomy. More important, at a mean follow-up interval of 5 months, mortality was 2.7% in the aspiration thrombectomy group compared with 4.4% in the PCI-only group ($p = 0.018$). Neither mechanical thrombectomy nor embolic protection devices were found to provide similar benefits or any benefit at all in the meta-analysis. Subsequently, the American College of Cardiology/American Heart Association (ACC/AHA) STEMI guidelines endorsed the use of aspiration thrombectomy with PCI in STEMI, with a Class IIa (Level of Evidence: B) recommendation (2). The recently updated 2013 ACCF/AHA STEMI guidelines retain this endorsement (3). Nonetheless, the use of aspiration thrombectomy during PCI in STEMI has remained controversial. On one hand, removal of some or possibly most of the offending thrombus at the culprit lesion site may prevent distal embolization, improve epicardial coronary flow, and reduce microvascular obstruction and the no-reflow phenomenon. On the other hand, the thrombectomy catheter itself is one more device that may cause distal thrombus embolization, and its insertion adds procedure time prior to definitive balloon angioplasty and/or stenting. Not everyone is convinced there is benefit. Partly this is because there has been a great deal of heterogeneity among individual clinical trials, most of which have been small, as was documented in the meta-analysis (1). The recently reported TROFI (Thrombus Aspiration on Flow Area in Patients With ST-Elevation Myocardial Infarction) trial (4) is likely not of much help either. Using optical frequency domain imaging, the TROFI investigators found in 141 STEMI patients that minimal flow area at the lesion site was no different when aspiration thrombectomy was performed prior to stenting compared with stenting alone. What that finding might mean is unknown at present. Myocardial blush grades, STR, and clinical events also were not different, but the TROFI trial was not designed or powered for those secondary outcomes.

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Meanwhile, in this issue of the *Journal*, Kumbhani et al. (5) of the previous meta-analysis have now updated their work with several important additions. A completely new meta-analysis was done, and this one included 5,534 patients from 25 trials. In addition to TIMI blush grades, STR, and intermediate-term mortality, the authors also examined data on infarct size, left ventricular function (ejection fraction; LVEF), and total ischemic time, hoping to gain insight into mechanisms of benefit. Similar to their previous findings, both TIMI blush grade 3 and STR were significantly better with aspiration thrombectomy compared with PCI only, and mortality at 6 months was lower (2.7% vs. 3.9%; $p = 0.049$). Mechanical thrombectomy again did not exhibit benefit compared with PCI alone. The data extracted regarding infarct size and LVEF are interesting but not conclusive, and this further reinforces the need for larger randomized trials that address these clinical measures directly using uniform methods. In the trials included in this meta-analysis, the follow-up assessments of infarct size and LVEF were done at a mean of 36 days (range: from hospital discharge to 6 months) and involved a variety of methods, including echocardiography, radionuclide perfusion studies, and magnetic resonance imaging. Selection bias, survival bias, and incomplete follow-up no doubt interfered with the comparisons, and it is not surprising that there were no differences in infarct size (mean: 17.1% vs. 17.3%; $p = 0.64$) or LVEF (mean: 53.0% vs. 52.8%; $p = 0.32$). Also, these relatively smaller infarcts and essentially normal LVEFs, coupled with the relatively lower mortalities, all suggest that stringent clinical selection allowed only less clinically ill patients into the trials. Again, this is no surprise.

Finally, it is important and noteworthy that these authors extracted ischemic times, which they are careful to define as *total ischemic time,* generally taken to be the time from onset of infarct symptoms until device activation. Mean ischemic times in these studies ranged from 2.4 h to 7.6 h. We and others have shown that total ischemic time is the correct focus of attention for reperfusion in STEMI (6,7). To further illustrate its importance, we used the ischemic time and infarct size data reported in the present meta-analysis (Fig. 1). Based on data from studies in animals and humans, it appears that a total ischemic time of <120 min is a worthwhile and achievable goal to keep infarct size as small as possible and mortality as low as possible. The present meta-analysis data do not contradict this. In conclusion, the proper

*Editorials published in the *Journal of the American College of Cardiology* reflect the views of the authors and do not necessarily represent the views of *JACC* or the American College of Cardiology.

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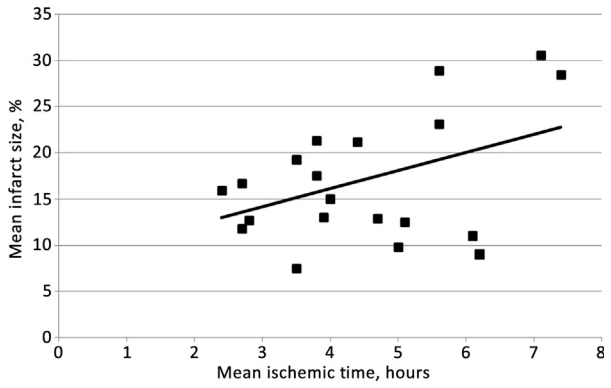

Figure 1 **Ischemic Time Versus Infarct Size**

The **x-axis** shows mean ischemic time in hours. The **y-axis** shows infarct size as a percentage of left ventricle. A simple regression line is shown; the data points are nonadjusted and nonweighted. Data from Tables 1 and 2 in the paper by Kumbhani et al. (5).

interpretation of this newly updated meta-analysis is that, like its predecessor, it provides solid, if indirect, evidence that aspiration thrombectomy prior to PCI in STEMI is useful and, like all infarct treatments, should be applied as early as possible, ideally within 120 min of ischemic time. We agree with the authors that until larger clinical trials are done, the present ACCF/AHA STEMI guideline recommendation (Class IIa, Level of Evidence: B) remains appropriate.

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Key Words: meta-analysis ■ mortality myocardial infarction ■ outcomes ■ thrombectomy.